## NASA Learning Technologies

# LTP Phase 2 Requirements Specification

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### Reviewers

| **Name** | **Function or Office** | **Comments** ("→" = addressed in) |
|---|---|---|
| Dr. Shelley Canright | NASA Education Enterprise Program Executive for Technology & Products | Rev 02 comments → Rev 03<br>Rev 03 comments → Rev 04 |
| John Entwistle | LT Project Review Committee | Concurs with Rev 01 |
| Ron Fortunato | LT Project Review Committee | Rev 01 comments → Rev 02 |
| Dr. Ed Landesman | LT Project Review Committee | Rev 01 comments → Rev 02 |
| Dr. Daniel Laughlin | LT Project Review Committee | Rev 01 comments → Rev 02 |
| Dr. Steven McGee | LT Project Review Committee | Rev 01 comments → Rev 02<br>Rev 02 comments → Rev 03 |
| Dr. Nitin Naik | LT Project Review Committee | Rev 01 comments → Rev 02 |
| Berta Alfonso | Project Manager – Virtual Lab | Rev 03 comments → Rev 04 |
| Dr. Horace Mitchell | Project Manager – DE PC | Rev 03 comments → Rev 04 |
| Christina O'Guinn | Project Manager – SSE | |
| Dr. Robert Shelton | Project Manager – Info Access. | Rev 03 comments → Rev 04 |

# Introduction

This document presents the universal requirements of the four Learning Technologies projects progressing to Phase 2. All four projects are offered Phase 2 funding subject to, among other factors, their acceptance and continued adherence to these requirements. The requirements have been developed by the LT Project Review Committee and the LT Project Office, and have undergone review by the Review Committee and the NASA Education Enterprise Program Executive for Technology and Products.

Comments or questions on these requirements should be addressed to Patrick Hogan, Learning Technologies Project Director, at Patrick.Hogan@nasa.gov.

# 1 General Requirements

All Phase 2 LT projects are subject to the following requirements.

## 1.1 Focus on Core Technology and Componentry

In order to ensure the widest utility of the project's technology, the projects shall focus their phase 2 efforts on developing componentry for use in educational applications. To ensure this, and to emphasize the technology's development as componentry, the project's core technology and software deliverables shall be integrated with at least two independently developed educational applications. One of these applications shall be selected by the LT Project Office; the other shall be recruited by the project's Project Manager. Arrangement for performance of the integration effort is the responsibility of the project team.

## 1.2 Collaboration with Educational Associates

In order to ensure educational value, educational appropriateness, and alignment with national standards of the project deliverables, the project shall recruit and work closely with one or more experienced educational technology experts familiar with the research and state of the art in the project's educational technology domain. These experts shall guide and assist the project team in its choices of educational material, delivery metaphors and user interface, and with technology evaluation of the project deliverables and the technology those deliverables incorporate. The LT Project Office can assist in recruitment of these experts. (See section 1.3 below.)

Additionally, the project manager or members of the project team designated by the project manager shall complete the Virtual Design Center online training in research-based educational technology design provided by NASA Classroom of the Future. (See http://www.cotf.edu/vdc for a description of the training.)

## 1.3 Collaboration with LT Project office

The LT Project Office will make available a technical and planning consultant (currently Tom Gaskins) to assist the project teams with software technology, project planning, and coordination with the Project Office. The office will also assist in locating and recruiting instructional technology consultants to help the project team discover and interpret education technology research that would guide them in their design and deliverable decisions (as described in section 1.2 above). The project manager shall keep these consultants continually apprised of significant decisions, of project status, and of any likelihood of deviations from the project's plans, deliverables or schedule.

## 1.4 Planning

Upon acceptance of these requirements, the project shall collaborate with the LT Office to compose an annual performance plan. This plan shall include a statement of goals and objectives, a comprehensive description of deliverables for the planning year, a schedule, and an evaluation plan to document outcomes and demonstrate progress toward achieving objectives.

The schedule shall include technology and deliverable milestones, as well as the recruitment, incorporation, and review of the educational technology experts. Upon mutual agreement between the project manager and the LT Project Office, this plan and schedule shall become a metric by which the project's performance is evaluated.

In addition, the project team shall clearly articulate how the plan contributes to the Education Enterprise annual performance goals that support NASA e-Education Objective (6.4) and Outcome 6.4.1 and Agency's strategic objectives and strategic outcomes for education.

Prior to final LT Project Office approval of annual project plans, those plans shall be approved by the Center Education Director of the project team's primary NASA center.

## 1.5 Portfolio Management

Under the auspices of the Education Enterprise's Technology & Products Office, the LT Project Office is implementing a portfolio management approach. This approach includes a rigorous evaluation of Phase 2 projects; periodic progress reports on performance metrics; annual performance evaluations using common criteria; and access to performance information for the entire portfolio. The portfolio management approach will provide information necessary for reallocation of resources; sunsets to projects, if necessary; and ensure a coordinated, non-duplicative set of Phase 2 projects that work together to achieve NASA's education goals.

The Education Enterprise has established operating principles. Every NASA-sponsored education program or activity is to be developed, implemented and evaluated according to these principles. LT Phase 2 projects shall build their technology tools in keeping with these *Education Program Operating Principles*:

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|---|---|
| **Customer focus** | Designed to respond to a need identified by the education community, a customer, or a customer group. |
| **Content** | Makes direct use of NASA content, people, or facilities to involve educators, students and/or the public in NASA science, technology, engineering, and mathematics. |
| **Pipeline** | Make a demonstrable contribution to attracting diverse populations to careers in science, technology, engineering, and mathematics. |
| **Diversity** | Reaches identified targeted groups. |
| **Evaluation** | Implement an evaluation plan to document outcomes and demonstrate progress toward achieving objectives. |
| **Partnership & Sustainability** | Achieve high leverage and/or sustainability through intrinsic design or the involvement of appropriate local, regional, or national partners in their design, development, and dissemination. |

### 1.5.1 Quarterly Review

The project shall undergo review each quarter of the project's duration. This review shall be conducted in-person with LT Office staff at the project's primary site. The reviews shall consist of a demonstration of the state of the project's technology and deliverables, an assessment of the project's status relative to its schedule, and an evaluation and possible adjustment of the project's direction and deliverables.

A quarterly report shall subsequently be submitted and made available from the LT Project Office internal web site for access by HQ Program Executive for Technology & Products Program Office and others, as identified.

### 1.5.2 Semi-annual Review of Funding

Project funding shall be evaluated mid-year (prior to start of third quarter of the fiscal year) relative to the demonstrated performance of the project team and to the educational value of the project's technology. Projects not meeting their deliverables, schedule or other commitments, or whose technology has or is clearly becoming obsolete, or has insufficient alignment with NASA education goals and objectives may have their LT funding reduced or eliminated. (Such a proposed action will be forwarded by the LT Project Office to HQ and acted upon only upon concurrence and/or further direction by the NASA Education Enterprise Program Executive for Technology and Products.)

## 1.6 Annual Review by LT Review Panel

A thorough, in-person project review by the LT Review Panel shall be held in September 2004 at a location determined by the LT Project Office. This review shall include a full demonstration and evaluation of the project in its then-current state, and a description of its technology and then-current direction. This is to ensure that the project's technology remains relevant to NASA's education mission, and that there is independent concurrence that the project is performing to goals. Project teams should expect to reasonably adjust their goals and plans subject to feedback from this review.

## 1.7 Domain-Expert Validation

Prior to the project's first annual review, the project's technology and proposed deliverables shall be formally presented to one or more scientific or technological forums appropriate to the project's topic material. The feedback from these presentations shall be considered in the project's annual review.

## 1.8 Enterprise CIO and Education Officer Review

Project teams shall present their projects annually to the appropriate NASA Enterprise Chief Information Officers and Education Officers.

As described in section 1.4 above, annual project plans shall be approved by the Center Education Director of the project team's primary NASA center.

## 1.9 Lack of Encumbrance on Dissemination

The project deliverables shall not be encumbered by licensing restrictions unacceptable to the LT Project Office. They shall allow public dissemination of object code, data, imagery and electronic models without payment of royalties, other fees, or "share-back" requirements, including those imposed by use of independently developed free or purchased software, hardware, or data.

All source forms of code, data, electronic imagery and models created or caused to be created (i.e., "contracted" or "out-sourced") by the project shall be unencumbered for public dissemination.

## 1.10 Hardware and Software Target

The project's deliverables shall operate with end-user interactive performance acceptable to the LT Office on personal computers running Windows XP Home and on those computers running Mac OS-X, at the then-current service release of these operating systems. Minimal hardware of these computers is a single 1.5 GHz CPU, 512 MB of RAM, one 40 GB disk, one CD ROM, 1024 by 768 graphics resolution, and additional graphics or audio hardware each costing no more than $400 at the time of project commencement. These requirements are meant to ensure that the project's deliverables will operate acceptably on computer hardware and software purchased today and typically used by students and educators. Operation on Linux is not a requirement.

Run-time requirements shall include only commonly required software, such as an operating system, expected to be present on the user's computer. Accessibility software (e.g., JAWS) may also be required by the project software if the accessibility software is expected to be a normal part of the user's computer environment. Also permissible as run-time requirements are freely available and commonly used software such as a Java virtual machine, .Net run-time, Acrobat Reader, and major-brand media players. Exceptions to this may be made for minimal-cost software, but only with the approval of the LT Office.

The existence at run-time of a high-speed connection to the internet or a local network cannot be assumed, but the project deliverables may provide significantly more functionality in the presence of such connections. If a connection does not exist, the user must be able to utilize a significant subset of the functionality and content.

Deliverables targeted to PDAs shall assume a Pocket PC 2003 or Palm operating system and a device costing less than $500 in late 2003.

## 1.11 Integration Feasibility

The developed technology shall be easy to integrate into independently developed applications by independent software developers. Integration ability shall be programming-language independent, and support at a minimum project-technology clients using that client's choice of either Java, C# or C++ at the then-current versions and development platforms of those languages on Windows XP and Mac OS-X operating systems. XML shall be used to convey data, execution instructions and configuration

information whenever appropriate. Existing appropriate and adequate standards shall be used when available.

## 1.12 Reliability

The project's software deliverables shall be thoroughly tested by the project team or its designee to ensure correct and trouble-free operation and behavior when interoperating with an application and an end-user.

## 1.13 Documentation

In support of item 1.11 above, the project shall provide professional quality documentation describing to software developers how to use the technology, and fully declaring and explaining the software or hardware interfaces. The documentation shall be accompanied by examples and, as appropriate to each project, a list of available data sources or other content repositories that the technology can operate with.

To the extent a deliverable provides direct, interactive access by a user, professional quality documentation and integrated electronic "Help" shall be provided with the deliverable.

## 1.14 Registration of Sharable Components and Content

To encourage re-use and discovery of the developed materials, the project shall register its software components, data and educational materials in appropriate public registries and databases. Suitable metadata describing the software shall accompany the registration. XML schemas defined by the project shall be registered with the NASA portal schema registry, and with other schema registries as appropriate.

## 1.15 Development Procedures and Mechanisms

The LT Office will establish procedures that projects shall use to protect, share and disseminate their deliverables. This will include source code control, defect tracking, electronic backup, and other commonly employed professional software development infrastructure. The Phase 2 projects shall actively participate in this infrastructure.

## 1.16 Best Practices for Software Development

The project deliverables shall be continually functional and available for operation on Windows XP PCs and Mac OS-X PCs. The LT Project Office is to possess operational, up-to-date source code, build and install instructions and installation software for all software deliverables. It is the responsibility of the project team to make reasonable efforts to ensure the LT Project Office is kept up-to-date.

## 1.17 Delivery

The LT Project Office is responsible for arranging intermediate and final dissemination of the project deliverables. The LT Project Office will establish guidelines and mechanisms that the project shall use to deliver materials to the LT Project Office.